

4
THE
PRACTICAL
GAUGER:
BEING
A Plain and Easie Method
OF
GAUGING
ALL SORTS OF
Brewing Vessels.

Whereunto is added,
A SHORT SYNOPSIS
OF THE
Laws of EXCISE.

By JOHN MAYNE.

London, Printed by W. G. for N. Brooke,
at the Angel in Cornhill. 1676.

THE
GALLERY

GALLERY



To the Honourable
PEREGRENE BERTIE,
ESQUIRE.

May it please Your Honour,

M*Y present Service is
so much the more
valuable to me, since
I was preferred thereto by Your
Recommendation, which I shall
endeavour to preserve with un-
wearied Industry and constant
Fidelity. Your Favour, Sir,
is a Blessing my Soul is too
narrow to enclose, and me*
A 3 *thinks*

[]

thinks I can hardly be reconciled
to that Divinity which calls
Pride a Sin. But if I am
guilty, I heartily beg Your par-
don, and permission to subscribe,

YOUR HONOURS

Most humbly devoted

Servant,

John Mayne.

To the Worshipful
PETER CALVERD,
SAMUEL VINCENT,
EDMUND BOSTOCK,
JOHN PARSONS,

And

RICHARD BRET,
ESQUIRES,

FARMERS of His Majesties
Revenue of *EXCISE* within
the Kingdom of *England*,
Dominion of *Wales*, and
Town of *Berwick* upon
Tweed;

John Mayne

Wisheth Increase of Happiness
here, and everlastingly
hereafter.



To the Reader.

HAVING been commanded by my Masters into the North-west Parts of this Kingdome, I found there many ingenious Men, employed in their Service, viz. the Revenue of Excise, which were willing to gain some little knowledge in the Art of Gauging, but had been frightened therefrom by the seeming difficulty of obtaining their desires. I thought it no disservice to endeavour to inform these Men, upon whose shouldrs the whole Matter of Fact, in this Affair, between the King and the Subject lay.

And

[]

And accordingly I wrote and read to some of them these short Rules thou hast now before thee, endeavouring to make the Art plain and easie, even to the meanest Capacity, without much expence of Time in reading the Text, or breaking his Teeth with hard Terms of Art: And not having leisure to write so many Copies, as my Friends in those Parts desired, and I could afford them, I am prevailed with to commit it to the Press. Farewell.

J. M.

A 5.

THE

, M. I.

E I T

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T H E
P R A C T I C A L
G A U G E R.

IT would be very convenient, that every *Gauger* were well acquainted with the Art of *Decimal Arithmetick*; but it is necessary that he be so well seen in *Vulgar*, as to be able to add, subtract, multiply, and divide any whole Numbers.

It is also necessary, that he understand the three sorts of Quantity,
viz.

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viz. a Line, a Superficies, and a Solid.

A Line hath length, but no breadth.

A Superficies hath length and breadth, but no depth.

A Solid hath length, breadth, and depth.

Moreover there is no kind of Quantity but is commensurable by some Common Measure thereto assign'd, as a Line by a Line of Inches, Feet, Poles, Furlongs, &c. and a Superficies by a Superficies, as the Square Inch, &c. and also a Solid by a Solid: So when it is known how many Inches, Poles, or Furlongs is contained in any Line, the length of that Line is said to be known; and when it is known how many square Inches, square Feet, or square Perches are contained within any Superficies, the Content or Area of that Superficies is said to be known; and also when it is known how many solid Inches are contained in any Solid,

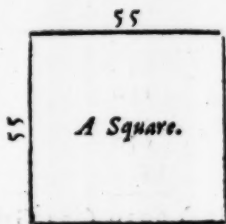
The Practical Gauger. 3

Solid, the Content of that Solid is known.

To find the Content of a Back in the form of a Square or Parallelogram.

The Rule is:

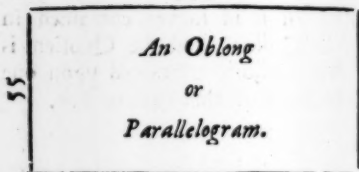
Multiply the length by the breadth, and the Product divide by 282 (the number of solid Inches contained in the Ale Gallon) and the Quotient is the Ale Gallons contained upon one Inch in depth of that Back or Tun.



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$$\begin{array}{r}
 55 \\
 55 \\
 \hline
 275 \\
 275 \\
 \hline
 282 \) \ 3025 \ (\ 10 \text{ Gallons.} \\
 \hline
 205 \\
 \hline
 110
 \end{array}$$



$$\begin{array}{r}
 55 \\
 110 \\
 \hline
 550 \\
 55 \\
 \hline
 282 \) \ 6050 \ (\ 21 \text{ Gallons.} \\
 \hline
 410 \\
 \hline
 128
 \end{array}$$

One

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One contains 10 Gallons, and $\frac{201}{182}$ parts of a Gallon; the other 21 Gallons and $\frac{121}{82}$ of a Gallon. To reduce which Fraction into Pints, you need only multiply the Remainder or Numerator by 8, and divide by the old Divisor, and the Quote will be the Pints contained in that Fraction.

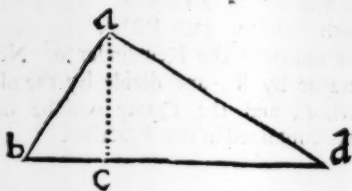
To find the Area or Content of one Inch of a Back or Tun, in the form of a Triangle, in Ale Gallons:

The Rule is:

Multiply the Line *ac* (*viz.* the Line falling perpendicularly from any Angle on its opposite Base) by half the Line *bcd*, here the Base, and the Product divide by 282, the Quotient will be the Ale Gallons contained in one Inch of depth upon that Triangle.

Ex

Example.



$$ac = 120$$

$$\frac{1}{2} bcd = 150$$

A. Gall. Pints.

$$282 \overline{) 18000} \quad (63 : 6 \frac{22}{141}$$

$$1080$$

$$234$$

$$8$$

$$282 \overline{) 1872} \quad (6 \frac{112}{241} \text{ or } \frac{22}{141}$$

$$180$$

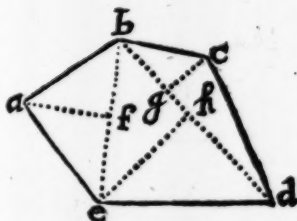
There is contain'd in the first Inch
of this Back or Tun 63 Ale Gallons,
6 Pints, and above an half.

But

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But admitting the Back or Tun be of an irregular Form, divide it into Triangles, and let fall Perpendiculars in each, and find their several Area's, as in the last Example, then add them together, and you have the Content or Area of the whole Figure.

Example.



First I find the Triangle *abe*.

$$\begin{array}{r}
 af = 230 \\
 \frac{1}{2} be = 130 \\
 \hline
 29900
 \end{array}$$

Now

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Now in the other two Triangles, the two Perpendiculars falling upon one common Base, I multiply the Sum of the Perpendiculars by half the Base, and that Product is the Area or Content of both Triangles.

$$\begin{array}{r}
 cg = 60 \\
 he = 220 \\
 \hline
 280 \\
 \frac{1}{2}bd = 250 \\
 \hline
 14000 \\
 56 \\
 \hline
 70000 \\
 29900 \\
 \hline
 \text{Ale Gall.} \\
 282 \) \ 99900 \ (\ 354 \ \frac{3}{4} \\
 1530 \\
 1200 \\
 \hline
 72
 \end{array}$$

So doth one Inch of this Back or Tun appear to contain of Ale Measure,

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sure, 9 Barrels, 3 Firkins, and 3 Gallons.

Here Note; That formerly the Ale Gallon was accounted to contain $288\frac{1}{4}$ Cube Inches; but by the care and pains of my good Friend, Mr. *Nicholas Gunton*, the just quantity of the Quart, remaining in the hands of the Chamberlains of His Majesties Exchequer, appears to be $70\frac{1}{2}$, as some of late have found to their no small cost. And I am of opinion, that if the Wine Gallon were carefully examined, it would prove to contain less than it is commonly holden to do, by so much as would improve the Revenue of the Crown some thousands *per annum*.

Now having shewed thee how to find the superficial Quantity of any Figure enclosed or bounded by Right Lines, if the Dimensions be alike above and below, multiply the Area by the Depth and you have the Content

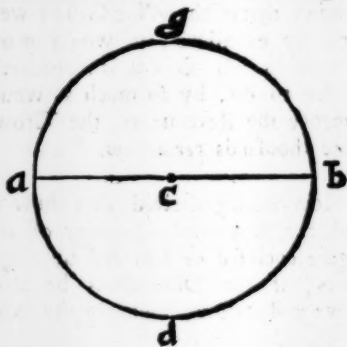
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tent of the whole; or by any part, and you will find thereby the Solidity of that part.

But if the Dimensions above and below be unequal, take your Dimensions or cross Diameters at every Foot or half Foot, and so find the Solidity.

Of a Circle.

A Circle is a Figure contained or bounded by one Line, which is called the Circumference, as the Line *a b g d*.



Within

Within which Line there is a Point, from whence all Lines drawn from the Circumference are equal : And that Point is called the Center, as the Point *c* : And through which all Right Lines drawn from one side of the Circumference to the other divide the Circle into two equal parts, and that Line is called the Diameter, as the Line *acb* ; and the two parts of the Circle, divided by the Diameter, are called Semi-circles, as the part *acbg* or *acbd*.

And although there is not yet found any true proportion between a Square and a Circle, (a Square Inch being our Common Measure) yet is there an Approximation found by *Vanculen*, which comes almost infinitely near the truth, being as Unity to 3.14159 &c. to the Square of the Semi-diameter. But the old Proportion comes near enough for common practice, viz. *As 14 to 11, so is the Square of the Diameter to the Area in Square Inches, &c.*

Ex.

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Example.

$$\text{Diameter } ab = 80$$

$$\begin{array}{r} 80 \\ \hline \end{array}$$

$$\text{Square of } ab = 6400$$

$$14 \cdot 11 :: 6400 \cdot 5028 \text{ Area in Square Inches.}$$

$$\begin{array}{r} 6400 \\ 6400 \\ \hline \end{array}$$

$$\begin{array}{r} 14 \) \ 70400 \ (\ 5028 \\ \underline{0040} \\ 120 \\ \hline 8 \end{array}$$

Which Area in Square Inches divided by 282 quote the Ale Gallons contained in one Inch of depth in that Circle, or by 231 the Wine Gallons.

Ex.

Example.

A. Gall. Pints.

$$\begin{array}{r} 282 \) \ 5028 \ (\ 17 : 6 \frac{20}{141} \\ \underline{2028} \\ 234 \\ 8 \end{array}$$

$$\begin{array}{r} 282 \) \ 1872 \ (\ 6 \frac{20}{141} \\ \underline{180} \end{array}$$

W. Gall. Pints.

$$\begin{array}{r} 231 \) \ 5028 \ (\ 21 : 6 \frac{10}{331} \\ \underline{408} \\ 177 \\ 8 \end{array}$$

$$\begin{array}{r} 231 \) \ 1416 \ (\ 6 \frac{10}{331} \\ \underline{30} \end{array}$$

But I would advise my young *Gauger* not to trouble himself with the
Inches,

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Inches, his business being to find the Gallons the shortest way he can: In order whereunto, let him observe the following Rule.

Having the Diameter of a Circle in Inches, to find the Area or Content in Ale or Wine Gallons.

The Rule.

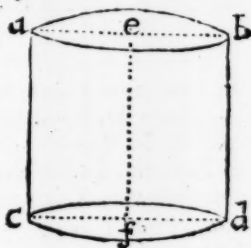
Square the Diameter (*viz.* multiply it by it self) and that Square or Product divide by 359 for Ale, and 294 for Wine, and the Quotes will be the Ale or Wine Gallons respectively, that shall be contain'd in a Circle of that Diameter, and one Inch in depth.

$$\begin{array}{r}
 ab = 80 \\
 \quad 80 \\
 \hline
 359 \) \ 6400 \quad (\ 17 \frac{221}{359} \\
 \underline{2810} \\
 297
 \end{array}$$

294

$$\begin{array}{r}
 \text{Wine Gall.} \\
 294 \cdot 6400 \quad (21 \frac{111}{147}) \\
 \underline{0520} \quad \text{prout suprà.} \\
 226
 \end{array}$$

If the Tun be in form of a Cylinder, viz. like the Rolling-stone of a Garden, the Circles above and below of equal Diameters, then to find the Content of that Tun, or any part thereof, you need only find the Area of the Circle, and multiply by the whole Depth, or such part as you desire, and the Product will be the Solidity of the whole, or part, respectively.



B

Di-

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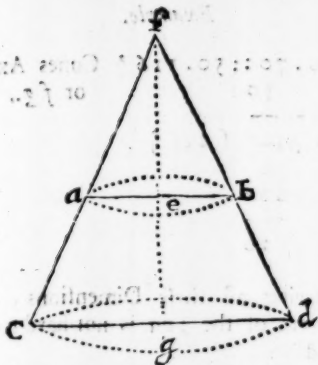
*Diameter a b or c d = 80 Inches, the
Area before found to be 17 gallons
6 pints, and the Depth = 40 Inches:
To find the Content.*

$$\begin{array}{r}
 \text{Area} = 17 : 6 \\
 \text{Depth } e f = 40 \\
 \hline
 680 \\
 30 \\
 \hline
 36 \) \ 710 \quad \text{Bar. Firk. Gall.} \\
 \quad 350 \\
 \quad \hline
 \quad 26
 \end{array}$$

The Content of this Tun in Beer Measure.

But if your round Tun have unequal Dimensions above and below, it is then taken to be the part of a Cone or round Pyramid, having the top cut off as the following Diagram; the whole Cone = *abc defg*, the part or Frustum = *abc deg*.

Having



Having the two Diameters and Depth of the Tun, to produce the whole Cone the Rule is by Proportion thus:

As the Semidifference of Diameters is to half the Diameter at the Base: So is the height of the Frustrum to the Cones whole Axis.

Admit $a b$ 80, $c d$ 140, $e g$ 50, then is the Difference 60, half the Base 70.

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Example.

$$30 \cdot 70 :: 50 \cdot 116 \frac{2}{3} \text{ Cones Axis, or } fg.$$

$$\begin{array}{r} 30 \overline{) 3500} \quad (116 \frac{2}{3} \\ \underline{300} \\ 200 \end{array}$$

Having all these Dimensions, the Content of the Tun is not hard to be found.

For if you find the Area of the Base, and multiply that Area by $\frac{2}{3}$ of the Altitude, or $\frac{1}{3}$ of the Area by the whole Altitude, the Product is the Solidity of the whole Cone. Then having found the whole Cone, find also the lesser Cone, and subtract that from the greater, the Remainder will be the Content of the Frustum.

Or if you would find the Content of the Frustum, without producing the whole Cone,

THE

8 d

The

The Rule is:

Multiply the Sum of the two Diameters by it self, then multiply the two Diameters by each other, subtract the lesser Product from the greater, and the Remainder multiply by the depth, the last Product divide by 1077, and the Quote is the Ale Gallons contained in that Tun.

$$\text{Diameter } a b = 80$$

$$\text{Diameter } c d = 140$$

$$\text{Sum of } a b \text{ and } c d = 220$$

$$220$$

$$4400$$

$$4400$$

$$\text{Product} = 48400$$

$$140$$

$$80$$

$$\text{Product} = 11200$$

B 3

Greater

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Greater Product = 48400

Lesser Product = 11400

Remainder = 37200

Depth *e g* = 50

A. Gall.

1077) 1860000 (1727

7830

2910

7560

The Content appears to be 1727 Ale Gallons, or 47 Barrels, 3 Firkins, 8 Gallons.

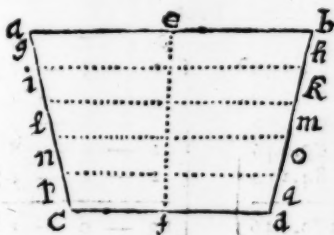
If it be desired in Feet or Inches, you may find all the Differences of the Diameters, at every Foot, half Foot, or Inch, by this Proportion :

As the whole Depth, is to the Difference of Diameters : So is any part of the Depth, to its respective difference of Diameter.

Then by Addition or Subduction, you have the Diameters all the way upward or downward. Or,

Or, if you please, you may take the Diameters actually, in the midst of every Foot or half Foot, and seek its Area in the Table of Area's hereto annexed, which Area multiplied by the Foot or half Foot gives the Solidity accordingly, without any sensible error. This way I would oblige the young *Gauger* to, if he be not ready at Proportion.

Example.



$$ab = 80$$

$$cd = 70$$

$$ef = 30$$

B 4

All

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All these Mean Diameters cut this Tun into so many Cylinders.

$$\text{Then is } \left\{ \begin{array}{l} gh = 79 \\ ik = 77 \\ lm = 75 \\ no = 73 \\ pq = 71 \end{array} \right\} \text{ Its Area } = \left\{ \begin{array}{l} 17.382 \\ 16.513 \\ 15.666 \\ 14.841 \\ 14.039 \end{array} \right.$$

Now having the Area of each Circle, which is an Arithmetical Mean of the half Foot, multiply this Area by 6, and the Product is the Solidity of that half Foot.

		B.		F.		G.			
104.2927	}	=	{	2	—	3	—	5 $\frac{1}{4}$	
99.078				2	—	3	—	0	
93.996				2	—	2	—	4	
89.046				2	—	1	—	8	
84.234				2	—	1	—	3 $\frac{1}{4}$	
<hr/> 470.646				<hr/>	13	—	0	—	2 $\frac{1}{2}$

This Tun cast up by the Rule, *pag.* 19.

$$\begin{array}{r} 80 \\ 70 \\ \hline 5600 \end{array}$$

80

$$\begin{array}{r}
 80 \\
 7000 \\
 \hline
 150 \\
 150 \\
 \hline
 7500 \\
 150 \\
 \hline
 22500 \\
 5600 \\
 \hline
 16900 \\
 30 \\
 \hline
 1077) 507000 (470 \frac{112}{1077} \\
 7610 \\
 \hline
 810
 \end{array}$$

Whereby appears not a Gallon difference.

If the Conjugate or Cross Diameters above and below are not equal, then do *Geometricians* call that Tun Elliptical; to reduce which to a Circle, there ought to be a Geometrical Mean taken, but the common practice

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is to add them together, and take the half, which if the Diameters differ not much, the error is the less.

Coppers are commonly taken at every 6 Inches, as that Tun in *pag. 21*.

To find the Content of a Coppers Crown, take this Rule:

Square the Diameter at the Base, to this add $\frac{4}{3}$ of the Square of the Crowns Altitude, the Sum multiply by the Altitude, the last Product divide by 718, the Quote is the Ale Gallons contained in that Crown.

To find the Content of the Malt Tun, in Quarters, Bushels, and Gallons, there can be no certain Rule in taking the Depth of the Goods, by reason of the difference in the goodness of Malt, some spending it self much more in the wetting than other; yet that considered, there may be some estimate given thereto, whereby a very considerable fraud may be discovered.

In

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In a square Mash Tun, divide the Product of the Length and Breadth by 227 for indifferent, or by 200 for the finest, and the Product will be the Gallons wetted; and for round Mash Tuns, let your Divisors be 288 or 260, respectively.

For *Cask-Gauging*, wholly full, I have given many Precepts and Examples in a Treatise called *The Merchants Companion*, Printed about a year since; but that the Reader may not be left here wholly without, take the following Rule, which considers the Cask as the Frustum of a Spheroid, that being the most general form.

To find the Content of a Cask in Ale or Wine Gallons.

The Rule.

To the doubled Square of the Bounding Diameter add the Square of the Head Diameter, and that Sum
mul-

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multiply by the Casks Length, the last Product divide by 1077, and the Quote is the Ale Gallons, or by 882 quores the Wine Gallons contained in that Cask.

Example.

A Cask $\left\{ \begin{array}{l} \text{Boung Diameter } 28 \\ \text{Head Diameter } 25 \\ \text{Length } \text{---} 36 \end{array} \right\} \text{Inches.}$

Head Diameter = 25

25

—

125

50

—

The Square = 625

Boung Diameter = 28

28

—

224

56

—

The Square = 784

784

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$$\begin{array}{r}
 784 \\
 784 \\
 625 \\
 \hline
 2193
 \end{array}$$

Casks Length = 36

$$\begin{array}{r}
 13158
 \end{array}$$

$$\begin{array}{r}
 6579 \\
 \hline
 \end{array}$$

A. Gall. Pints.
1077) 78948 (73 : 2 $\frac{442}{1077}$

$$\begin{array}{r}
 3558 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 327 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 8 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 1077) 2616 (2 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 462
 \end{array}$$

The Content of this Cask is 73 Ale-Gallons, 2 Pints, and almost an half.

Or, by the Table of Area's, thus :

To twice the Area of the Bounge Circle in Gallons and parts add the Area

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Area of the Head Circle, the Sum of these multiply by $\frac{1}{3}$ of the Casks Length, and the Product is the Content in Gallons and parts, as in the former Example.

$$\text{Area of } 28 = 2.184$$

$$2.184$$

$$\text{Area of } 25 = 1.741$$

$$6.109$$

$$\frac{1}{3} \text{ of the Length} = 12$$

$$\text{The Content} = 73.308 \text{ Ale Gall.}$$

Which Fraction being reduced is 2 Pints and better, as was before found.

anollO dIA ni e'sotA solotIO

27.	7.	A.	2.	7.
TABLE OF Area's of CIRCLES IN ALE GALLONS AND MILESIMAL PARTS, To every Quarter of an Inch, From 1 to 12 Foot of Diameter.				

Circles Area's in Ale Gallons.

Inches.	Area.	.25	.5	.75
10	0.278	0.293	0.307	0.322
11	0.337	0.352	0.368	0.384
12	0.401	0.418	0.435	0.453
13	0.471	0.489	0.508	0.527
14	0.546	0.565	0.586	0.606
15	0.627	0.648	0.669	0.691
16	0.713	0.731	0.758	0.781
17	0.805	0.824	0.853	0.877
18	0.902	0.923	0.953	0.979
19	1.005	1.027	1.059	1.086
20	1.114	1.142	1.170	1.199
21	1.228	1.258	1.287	1.317
22	1.348	1.379	1.410	1.441
23	1.473	1.505	1.538	1.571
24	1.604	1.638	1.672	1.706
25	1.741	1.776	1.811	1.847
26	1.883	1.919	1.956	1.993
27	2.030	2.068	2.106	2.175
28	2.184	2.223	2.262	2.302
29	2.342	2.383	2.424	2.465

Circles Area's in Ale Gallons.

Inches.	Area.	.25	.5	.75
30	2.507	2.549	2.591	2.634
31	2.676	2.720	2.764	2.808
32	2.852	2.896	2.941	2.987
33	3.033	3.079	3.126	3.172
34	3.220	3.267	3.315	3.363
35	3.412	3.461	3.510	3.560
36	3.610	3.660	3.710	3.761
37	3.813	3.864	3.916	3.969
38	4.022	4.075	4.128	4.182
39	4.236	4.291	4.345	4.401
40	4.456	4.512	4.568	4.625
41	4.682	4.739	4.797	4.855
42	4.913	4.972	5.031	5.090
43	5.150	5.210	5.270	5.331
44	5.392	5.453	5.515	5.577
45	5.640	5.703	5.766	5.829
46	5.893	5.957	6.022	6.087
47	6.152	6.218	6.284	6.350
48	6.417	6.484	6.551	6.619
49	6.687	6.755	6.824	6.893

Circles Area's in Ale Gallons.

Inches.	Area.	.25	.5	.75
50	6.963	7.033	7.103	7.173
51	7.244	7.315	7.387	7.459
52	7.531	7.603	7.676	7.750
53	7.823	7.897	7.972	8.046
54	8.121	8.197	8.272	8.348
55	8.425	8.502	8.579	8.656
56	8.734	8.812	8.891	8.970
57	9.049	9.128	9.208	9.288
58	9.369	9.450	9.531	9.613
59	9.695	9.777	9.860	9.943
60	10.026	10.110	10.194	10.279
61	10.363	10.448	10.534	10.620
62	10.706	10.792	10.879	10.970
63	11.054	11.142	11.230	11.320
64	11.408	11.497	11.587	11.677
65	11.767	11.868	11.949	12.040
66	12.132	12.224	12.316	12.409
67	12.502	12.596	12.690	12.784
68	12.878	12.973	13.068	13.164
69	13.260	13.356	13.453	13.550

Circles Area's in Ale Gallons.

Inches.	Area.	.25	.5	.75
70	13.647	13.745	13.843	13.941
71	14.040	14.139	14.238	14.338
72	14.438	14.539	14.639	14.740
73	14.842	14.944	15.046	15.148
74	15.251	15.354	15.458	15.562
75	15.666	15.771	15.876	15.981
76	16.087	16.193	16.299	16.406
77	16.523	16.620	16.728	16.836
78	16.945	17.053	17.162	17.270
79	17.382	17.492	17.603	17.713
80	17.825	17.936	18.048	18.160
81	18.273	18.386	18.499	18.613
82	18.727	18.841	18.956	19.071
83	19.187	19.302	19.418	19.535
84	19.652	19.769	19.886	20.004
85	20.122	20.241	20.360	20.479
86	20.599	20.718	20.840	20.959
87	21.088	21.202	21.323	21.445
88	21.560	21.691	21.814	21.937
89	22.061	22.185	22.309	22.434

Circles Area's in Ale Gallons.

Inches.	Area.	.25	.5	.75
90	22.559	22.685	22.811	22.937
91	23.063	23.190	23.318	23.445
92	23.573	23.701	23.830	23.959
93	24.088	24.217	24.348	24.478
94	24.609	24.740	24.872	25.003
95	25.136	25.268	25.401	25.534
96	25.667	25.801	25.936	26.070
97	26.205	26.340	26.476	26.612
98	26.748	26.885	27.022	27.159
99	27.297	27.435	27.573	27.712
100	27.851	27.990	28.130	28.270
101	28.411	28.552	28.693	28.834
102	28.976	29.118	29.261	29.404
103	29.547	29.691	29.835	29.979
104	30.124	30.269	30.414	30.560
105	30.706	30.852	30.999	31.146
106	31.293	31.441	31.589	31.738
107	31.887	32.036	32.185	32.335
108	32.485	32.636	32.787	32.970
109	33.090	33.242	33.394	33.577

Circles Area's in Ale Gallons.

Inches.	Area.	.25	.5	.75
110	33.700	33.853	34.007	34.192
111	34.315	34.470	34.625	34.812
112	34.936	35.093	35.249	35.437
113	35.563	35.721	35.878	36.037
114	36.195	36.354	36.513	36.673
115	36.833	36.993	37.154	37.315
116	37.476	37.638	37.800	37.962
117	38.125	38.288	38.452	38.616
118	38.780	38.944	39.109	39.274
119	39.440	39.606	39.772	39.938
120	40.105	40.273	40.440	40.608
121	40.777	40.945	41.114	41.284
122	41.453	41.623	41.794	41.965
123	42.136	42.307	42.479	42.651
124	42.824	42.997	43.170	43.343
125	43.517	43.692	43.866	44.041
126	44.216	44.392	44.568	44.744
127	44.921	45.098	45.275	45.453
128	45.631	45.809	45.988	46.167
129	46.347	46.527	46.707	46.887

Circles Area's in Ale Gallons.

Inches.	Area.	.25	.5	.75
130	47.068	47.249	47.431	47.613
131	47.795	47.978	48.161	48.384
132	48.527	48.712	48.896	49.081
133	49.266	49.451	49.637	49.823
134	50.009	50.196	50.383	50.571
135	50.758	50.946	51.135	51.324
136	51.513	51.703	51.893	52.083
137	52.273	52.464	52.656	52.847
138	53.039	53.232	53.424	53.618
139	53.811	54.005	54.199	54.393
140	54.588	54.783	54.979	55.174
141	55.371	55.567	55.764	55.961
142	56.159	56.357	56.555	56.754
143	56.953	57.152	57.352	57.592
144	57.752	57.953	58.154	58.395

To

The Practical Gauger. 37

To make any Number in the precedent Table,

The Rule is:

Divide the Square of the Diameter by 359, and the Quote exhibits the Area of that Circle in Ale Gallons.

Example.

$$\begin{array}{r} 30 \\ 30 \\ \hline 359 \overline{) 900} \quad (2.507 > \\ 1810 \\ \hline 2500 \end{array}$$

Thus may be made any Number, greater or lesser than the Table doth exhibit, the difference here being not $\frac{1}{1000}$ part of a Gallon.

To

38 *The Practical Gauger.*

To make a Table of $\frac{1}{3}$ ds of Area's
of Circles in Wine Gallons,

The Rule is:

Multiply $\frac{1}{3}$ of the Square of the
Diameter by .0034, or multiply the
whole Square by .0034 and the Pro-
duct divide by 3; and the Product of
the former Work, or the Quotient of
the latter, is the Circles Area.

Example.

*What is the $\frac{1}{3}$ ^d of the Area of that
Circle in Wine Gallons whose Dia-
meter is 30 Inches?*

$$\begin{array}{r} \text{Diameter} = 30 \\ \quad 30 \\ \hline \end{array}$$

$$\text{The Square} = 900$$

$\frac{1}{3}$ of q. = 300	q. = 900	
Multiplic' .0034	.0034	
<u>1200</u>	<u>3600</u>	
900	2700	
<u>1.0200</u>	<u>3.0600</u>	W. G.
Answer 1.0200	3) 3.0600	(1.02
		A

A
TABLE
Of One thirds of
AREA's of CIRCLES
IN
WINE GALLONS:
CALCULATED
To every quarter of an Inch;
From 10 to 60 Inches of Diameter.

C

One thirds of Circles Area's

Inches.	Area.	.25	.5	.75
10	0.1133	0.1190	0.1250	0.1330
11	0.1371	0.1434	0.1499	0.1565
12	0.1632	0.1701	0.1771	0.1842
13	0.1915	0.1990	0.2066	0.2143
14	0.2211	0.2301	0.2383	0.2466
15	0.2550	0.2636	0.2723	0.2811
16	0.2901	0.2993	0.3086	0.3180
17	0.3275	0.3372	0.3471	0.3570
18	0.3672	0.3775	0.3879	0.3984
19	0.4091	0.4200	0.4310	0.4420
20	0.4533	0.4647	0.4763	0.4880
21	0.4998	0.5117	0.5237	0.5361
22	0.5485	0.5609	0.5734	0.5866
23	0.5995	0.6126	0.6259	0.6393
24	0.6528	0.6665	0.6803	0.6943
25	0.7083	0.7226	0.7370	0.7515
26	0.7661	0.7808	0.7969	0.8110
27	0.8262	0.8416	0.8571	0.8727
28	0.8885	0.9044	0.9206	0.9368
29	0.9531	0.9696	0.9863	1.0031

in Wine Gallons.

Inches.	Area.	.25	.5	.75
30	1.0200	1.0370	1.0543	1.0716
31	1.0891	1.1064	1.1245	1.1425
32	1.1605	1.1787	1.1971	1.2156
33	1.2342	1.2530	1.2719	1.2910
34	1.3101	1.3298	1.3490	1.3686
35	1.3883	1.4082	1.4283	1.4485
36	1.4688	1.4893	1.5099	1.5306
37	1.5513	1.5726	1.5938	1.6184
38	1.6365	1.6581	1.6799	1.7018
39	1.7238	1.7460	1.7683	1.7908
40	1.8133	1.8361	1.8589	1.8819
41	1.9051	1.9285	1.9519	1.9755
42	1.9992	2.0231	2.0471	2.0713
43	2.0955	2.1199	2.1445	2.1693
44	2.1941	2.2201	2.2443	2.2696
45	2.2950	2.3206	2.3463	2.3722
46	2.3981	2.4243	2.4506	2.4770
47	2.5035	2.5303	2.5571	2.5840
48	2.6112	2.6385	2.6659	2.6934
49	2.7211	2.7489	2.7736	2.8051

One thirds of Circles Area's.

Inches.	Area.	.25	.5	.75
50	1.8333	2.8617	2.8867	2.9190
51	1.9478	2.9768	3.0059	3.0352
52	3.0645	3.0941	3.1237	3.1536
53	3.1835	3.2136	3.2439	3.2743
54	3.3048	3.3355	3.3663	3.3972
55	3.4283	3.4596	3.4910	3.5224
56	3.5541	3.5859	3.6179	3.6500
57	3.6822	3.7146	3.7471	3.7797
58	3.8125	3.8454	3.8786	3.9118
59	3.9451	3.9786	4.0123	4.0461
60	4.0800	4.1141	4.1483	4.1826

To Gauge a Cask by the precedent Table,

The Rule is:

To the Double of the Bounding Diameter add the Head Diameter, their Sum multiply by the Length, and the Product is the Content.

Ex-

Example.

*A Casks Bounding Diameter 29.5 Inches,
Head Diameter 23, and the Length
48 Inches, I demand its Content in
Wine Gallons?*

B. D. Tabular Number 29.5 = .9863

The same again .9863

H. D. Tabular Number 23 = .5995

—————
Their Sum = 2.5721

The Length = 48

—————
205768

102884

—————
123.4608

Answer 123 $\frac{1}{2}$ Wine Gallons, *ferð.*

1844-1845

1. 1st of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.
2. 2nd of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.
3. 3rd of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.
4. 4th of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.
5. 5th of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.
6. 6th of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.
7. 7th of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.
8. 8th of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.
9. 9th of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.
10. 10th of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.

11. 11th of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.

12. 12th of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.
13. 13th of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.
14. 14th of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.
15. 15th of Jan. 1844. A fine day, with a light
breeze from the N. E. and a few clouds in the
evening. The temperature was 45° at 10 P.M.

A
T A B L E
O F
E X C I S E,

At iij. s. iij. d. *per* Barrel,

To every Firkin,

From One to Thirty Barrels.

A Table of Excise, at 3 s. 3 d. per Bar.

Bar- rels.				$\frac{1}{4}$			
	l.	s.	d.	l.	s.	d.	q.
1	00	03	03	00	04	00	3
2	00	06	06	00	07	03	3
3	00	09	09	00	10	06	3
4	00	13	00	00	13	09	3
5	00	16	03	00	17	00	3
6	00	19	06	01	00	03	3
7	01	02	09	01	03	06	3
8	01	06	00	01	06	09	3
9	01	09	03	01	10	00	3
10	01	12	06	01	13	03	3
11	01	15	09	01	16	06	3
12	01	19	00	01	19	09	3
13	02	02	03	02	03	00	3
14	02	05	06	02	06	03	3
15	02	08	09	02	09	06	3
16	02	12	00	02	12	09	3
17	02	15	03	02	16	00	3
18	02	18	06	02	19	03	3
19	03	01	09	03	02	06	3
20	03	05	00	03	05	09	3
21	03	08	03	03	09	00	3
22	03	11	06	03	12	03	3
23	03	14	09	03	15	06	3
24	03	18	00	03	18	09	3
25	04	01	03	04	02	00	3
26	04	04	06	04	05	03	3
27	04	07	09	04	08	06	3
28	04	11	00	04	11	09	3
29	04	14	03	04	15	00	3
30	04	17	06	04	18	03	3

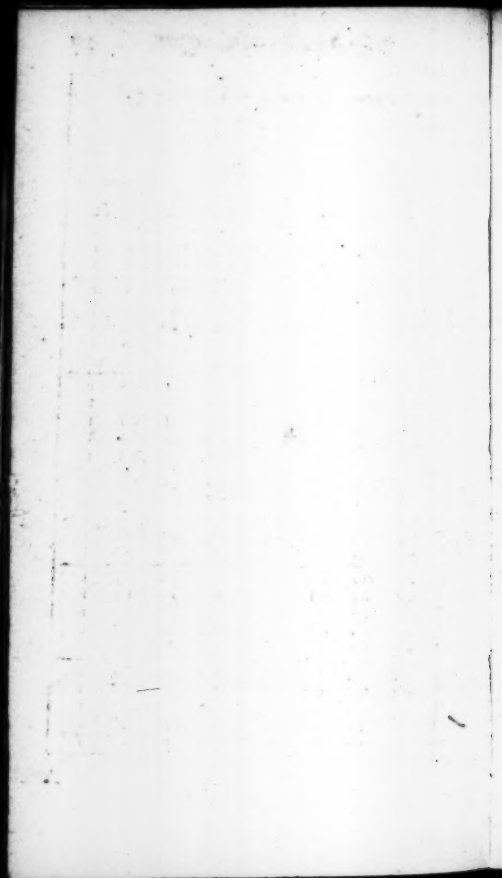
The Practical Gauger. 47

From 1 to 30 Barrels

$\frac{1}{2}$				$\frac{1}{4}$			
l.	s.	d.	q.	l.	s.	d.	q.
00	04	10	2	00	05	08	1
00	08	01	2	00	08	11	1
00	11	04	2	00	12	02	1
00	14	07	2	00	15	05	1
00	17	10	2	00	18	08	1
01	01	01	2	01	01	11	1
01	04	04	2	01	05	02	1
01	07	07	2	01	08	05	1
01	10	10	2	01	11	08	1
01	14	01	2	01	14	11	1
01	17	04	2	01	18	02	1
02	00	07	2	02	01	05	1
02	03	10	2	02	04	08	1
02	07	01	2	02	07	11	1
02	10	04	2	02	11	02	1
02	13	07	2	02	14	05	1
02	16	10	2	02	17	08	1
03	00	01	2	03	00	11	1
03	03	04	2	03	04	02	1
03	06	07	2	03	07	05	1
03	09	10	2	03	10	08	1
03	13	01	2	03	13	11	1
03	16	04	2	03	17	02	1
03	19	07	2	04	00	05	1
04	02	10	2	04	03	08	1
04	06	01	2	04	06	11	1
04	09	04	2	04	10	02	1
04	12	07	2	04	13	05	1
04	15	10	2	04	16	08	1
04	19	01	2	04	19	11	1

C 5

A



A
TABLE
OF THE
Content of Cylinders
IN
ALE GALLONS
AND
CENTESIMAL PARTS,
From twelve to sixty Inches
of Diameter,
And to eight Inches in Depth:

Content of Cylinders

Diam.	DEPTH.			
	Area.	2	3	4
12	0.40	0.80	1.20	1.60
13	0.47	0.94	1.41	1.88
14	0.55	1.10	1.65	2.20
15	0.63	1.26	1.89	2.52
16	0.71	1.42	2.13	2.84
17	0.80	1.60	2.40	3.20
18	0.90	1.80	2.70	3.60
19	1.00	2.00	3.00	4.00
20	1.11	2.22	3.33	4.44
21	1.23	2.46	3.69	4.92
22	1.35	2.70	4.05	5.40
23	1.47	2.94	4.41	5.88
24	1.60	3.20	4.80	6.40
25	1.74	3.48	5.22	6.96
26	1.88	3.76	5.64	7.72
27	2.03	4.06	6.09	8.12
28	2.18	4.36	6.54	8.72
29	2.34	4.68	7.02	9.36
30	2.51	5.02	7.53	10.04
31	2.68	5.36	8.04	10.72

in Gallons and hundred parts.

DEPTH.

5	6	7	8
2.00	2.40	2.80	3.20
2.35	2.62	3.29	3.76
2.75	3.30	3.85	4.40
3.15	3.78	4.41	5.04
3.55	4.26	4.97	5.68
4.00	4.80	5.60	6.40
4.50	5.40	6.30	7.20
5.00	6.00	7.00	8.00
5.55	6.66	7.77	8.88
6.15	7.38	8.61	9.84
6.75	8.10	9.45	10.80
7.35	8.82	10.29	11.76
8.00	9.60	11.20	12.80
8.70	10.44	12.18	13.92
9.40	11.28	13.16	15.04
10.15	12.18	14.21	16.24
10.90	13.08	15.26	17.44
11.70	14.04	16.38	18.72
12.55	15.06	17.57	20.08
13.40	16.08	18.76	21.44

Content of Cylinders

Diam.	DEPTH.			
	Area.	2	3	4
32	2.85	5.70	8.55	11.40
33	3.03	6.06	9.09	12.12
34	3.22	6.44	9.66	12.88
35	3.41	6.82	10.23	13.64
36	3.61	7.22	10.83	14.44
37	3.81	7.62	11.43	15.24
38	4.02	8.04	12.06	16.08
39	4.24	8.48	12.72	16.96
40	4.46	8.92	13.38	17.84
41	4.68	9.36	14.04	18.72
42	4.91	9.82	14.73	19.64
43	5.15	10.30	15.45	20.60
44	5.39	10.78	16.17	21.56
45	5.64	11.28	16.92	22.56
46	5.89	11.78	17.67	23.56
47	6.15	12.30	18.45	24.60
48	6.42	12.84	19.26	25.68
49	6.69	13.38	20.07	26.76
50	6.96	13.92	20.88	27.84
51	7.24	14.48	21.72	28.96

in Gallons and hundred parts.

DEPTH.

5	6	7	8
14.25	17.10	19.95	22.80
15.15	18.18	21.21	24.24
16.10	19.32	22.54	25.76
17.05	20.46	23.87	27.28
18.05	21.66	25.27	28.88
19.05	22.86	26.67	30.48
20.10	24.12	28.14	32.16
21.20	25.44	29.68	33.92
22.30	26.76	31.22	35.68
23.40	28.08	32.76	37.44
24.55	29.46	34.37	39.28
25.75	30.90	36.05	41.20
26.95	32.34	37.73	43.12
28.20	33.84	39.48	45.12
29.45	35.34	41.22	47.12
30.75	36.90	43.05	49.20
32.10	38.52	44.94	51.36
33.45	40.14	46.83	53.52
34.80	41.76	48.72	55.68
36.20	43.44	50.68	57.92

Content of Cylinders

DIA.	DEPTH.			
	Area.	2	3	4
52	7.53	15.06	22.59	30.12
53	7.82	15.64	23.46	31.28
54	8.12	16.24	24.36	32.48
55	8.42	16.84	25.26	33.68
56	8.73	17.46	26.19	34.92
57	9.05	18.10	27.15	36.20
58	9.37	18.74	28.11	37.48
59	9.69	19.38	29.07	38.76
60	10.03	20.06	30.09	40.12

in Gallons and hundred parts.

DEPTH.

<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
37.65	45.18	52.71	60.24
39.10	46.92	54.74	62.56
40.60	48.72	56.84	64.96
42.10	50.52	58.94	67.36
43.65	52.38	61.11	69.84
45.25	54.30	63.35	72.40
46.84	56.22	65.59	74.96
48.45	58.14	67.83	77.52
50.15	60.18	70.21	80.24

The

56 *The Practical Gauger.*

The Use of the precedent Table.

Having taken the Diameter of the Vessel, and also the Depth of the Liquor, seek the Diameter in the first Column of the Table, and casting your Eye upwards, you find over all the other Columns (except that for 1 Inch of Depth, over which stands the Title *Area*) one of the Digits, amongst which you shall find your Depth of Liquor, if it exceed not 8 Inches, then under that Figure, and against your Diameter you shall find your number of Gallons and parts.

Example.

To find the Content of a Cylinder, whose Diameter is 38, and Depth 4 Inches.

I first seek the Diam. 38, and against it in the Column under 4 I find 16.08, which is 16 Gallons and $\frac{8}{100}$ parts.

To reduce which Fraction into
 $\begin{array}{r} .08 \\ 8 \\ \hline .64 \end{array}$ Pints, multiply it by 8, and cut off two places in the Product, the figures to the left hand are Pints, and those cut off parts of a Pint, as in the Margin.

A
T A B L E
OF
AREA's of SEGMENTS
OF A
C I R C L E,
Whose whole *Area* is 2, and the
Radius divided into 100 p^{ts},
Calculated
To the $\frac{1}{10000}$ part of a Square Inch.

Area's of Segments.

V	Area	V	Area	V	Area	V	Area
1	.0017	99	.9983	26	.2066	74	.7934
2	.0048	98	.9952	27	.2178	73	.7822
3	.0087	97	.9913	28	.2292	72	.7708
4	.0134	96	.9866	29	.2407	71	.7593
5	.0187	95	.9813	30	.2523	70	.7477
6	.0245	94	.9755	31	.2640	69	.7360
7	.0308	93	.9692	32	.2759	68	.7241
8	.0375	92	.9625	33	.2878	67	.7122
9	.0446	91	.9554	34	.2998	66	.7002
10	.0520	90	.9480	35	.3119	65	.6881
11	.0598	89	.9402	36	.3241	64	.6759
12	.0680	88	.9320	37	.3364	63	.6636
13	.0764	87	.9236	38	.3487	62	.6513
14	.0851	86	.9149	39	.3611	61	.6389
15	.0941	85	.9059	40	.3735	60	.6265
16	.1033	84	.8967	41	.3860	59	.6140
17	.1127	83	.8873	42	.3986	58	.6014
18	.1224	82	.8776	43	.4112	57	.5888
19	.1323	81	.8677	44	.4238	56	.5762
20	.1424	80	.8576	45	.4364	55	.5636
21	.1527	79	.8473	46	.4491	54	.5509
22	.1631	78	.8369	47	.4618	53	.5382
23	.1737	77	.8263	48	.4745	52	.5255
24	.1845	76	.8155	49	.4873	51	.5127
25	.1955	75	.8045	50	.5000	50	.5000

The Use of the precedent Table is very considerable in *Geometry*, but my present intention is to apply it to *Cask-Gauging*, viz. To find the vacant *Frustums* in a *Cask* partly full, lying with its *Axis* parallel to the *Horizon*, the *Cask* being taken as the *Frustum* of a *Spheroid* cut with two *Planes* parallel, bisecting the *Axis* at *Right Angles*.

And here it is requisite, the *Boung* and *Head Diameters*, *Casks Length*, the whole *Content*, and dry or wet *Inches* be known. Then, if the *Question* be what is wanting, or what is remaining in the *Cask*? divide either the dry or wet *Inches* by the *Boung Diameter*, and the *Quote* seek in the *Table*, under *V* or *Versed Sine*, against it stands a number, which multiplied by the *Content* exhibits the *Vacuity*, if your *Dividend* were the dry, or the remaining *Liquor*, if it were the wet *Inches*.

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A SHORT
SYNOPSIS
O R
INDEX
OF THE
LAWS OF EXCISE.



LONDON:
Printed by *William Godbid*, 1676.

REPORT

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D I 10 Some

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*Some Examples of the Use of this
Table of Area's of Segments,
in finding the Vacuity of Cask.*

QUEST. I.

*What is the Ullage of a Cask, whose
Boung Diameter is 28 Inches, Con-
tent 60 Gallons, and dry Inches 7?*

According to the precedent Rule,
I divide 7 by 28, which I do by ad-
ding two Cyphers, thus :

$$\begin{array}{r} 28 \overline{) 7.00} \quad (25 \\ \underline{140} \\ 0 \end{array}$$

Then seeking 25 in the Table in the
Column under V, in the next Column
against it I find .1955, which number
I multiply by the whole Content, and
cutting off four places toward the right
hand of the Product, it exhibits the
Ullage

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Ullage or Wants in that Cask in Gallons and parts.

Example.

Tabular Number .1955	
Content	60
<hr/>	
Ullage	11.7300

So is the Ullage or Wants 11 Gallons and almost $\frac{1}{4}$ of a Gallon.

QUEST. II.

What quantity of Liquor is there remaining in this Cask?

Divide the wet Inches by the Bung Diameter, after this manner:

$$\begin{array}{r} 18 \) \ 2100 \ (75 \\ \underline{140} \\ 0 \end{array}$$

Against which number (75) I find
D 2 in

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in the Table .8045, which I multiply by the whole Content as before, and the Product gives the quantity of remaining Liquor.

Example.

Tabular Number .8045

Content 60

Remaining Liquor 48.2700

Wants 11.7300

Proof 60.0000

Now if after Division there happen a Remainder, and that be above half the Divisor, I take the next bigger number; or if it be less than half the Divisor, I take the next lesser number, as in the following Examples.

QUEST.

QUEST. III.

*If in the fore-mentioned Cask there be
9 Inches of the Bottom Diameter dry,
what is the Wants?*

$$\begin{array}{r}
 28 \overline{) 9.00} \quad (32 \\
 \underline{56} \\
 340 \\
 \underline{280} \\
 60
 \end{array}$$

Here the Remainder being under half
the Divisor I take 32,

Whose Area is .2759
Which I mult. by the whole Cont. 60

The Ullage or Wants 16.5540

QUEST. IV.

*There being 19 wet Inches; what is
the remaining Gallons?*

$$\begin{array}{r}
 28 \overline{) 1900} \quad (67 \\
 \underline{168} \\
 220 \\
 \underline{168} \\
 52 \\
 \underline{56} \\
 4
 \end{array}$$

D 3

Here

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Here the Remainder being above half
the Divisor, I take the next bigger
number, viz. 68,

Whose Area is .7241
Whole Content 60

Quantity remaining 43.4460
To which add the Ullage 16.5540

Makes 60.0000
propt supra.

THE

THE
DESCRIPTION
AND
USE
OF the
GAUGING - RULE.

THE AMERICAN

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THE
DESCRIPTION & USE
OF THE
GAUGING-RULE.

THis Rule is commonly four Foot in length, and is made to double in four joints, for convenient portage: It hath also four Sides, on which are drawn several Lines, *viz.*

1. There is two Lines called *Diagonals*, the one for Wine, the other for Beer or Ale-measure. These are so commonly known, that I suppose there are few Officers but are well acquainted with them; however, lest any should be ignorant, take this following advice.

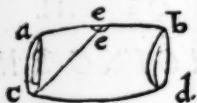
D 5

Put

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Put the end which is cut slope-ways in at the Bounge-hole, and let it touch the bottom of the Head, the Number that appears at the Bounge is the Number of Ale or Wine Gallons respectively.

As for Example.



a b c d a Cask.

Put your Rule down at the Bounge-hole *e* to the bottom of the Head *c*, if 60 appear at the Bounge on the Diagonal for Wine, then is the Content 60 Wine Gallons, and almost 49 Ale Gallons, for the Sub-divisions between the Numbers from 10 upwards signify each one Gallon.

This way will give a very good estimate of the Content of all Cask, in the form of the *London Beer Barrel*,
or

or the *French* wine Hogshead. These Lines being together serve also very well for a Table of Reduction of Wine into Ale measure, and the Converse, by inspection only.

2. On another Side or Face there is put a Line of Inches, from 1 to 48 Inches, and each decimally divided; and also upon the same Side you have *Oughtred's* Gauge-Line, it being a Line of One thirds of Area's of Circles, in Wine Gallons, by which you may Gauge a Cask after this manner: Put your Rule down at the Bounding perpendicularly, observing what Number appears just even with the inside of the Cask, admit it be 7, set that down twice, then take the Diameter at the Head, and let that shew you 6 upon the same Line, set that down to the former, add these three Numbers together, and multiply the Sum by the Casks Length, here 30, then cut off one place from the Product toward the right hand, and the Figures toward the left hand are your Number of Wine.

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 Wine Gallons contained in the Cask.

Example.

.7

.7

.6

—

20

Casks Length = 30

—

Casks Content = 60.0 Wine Gall.

Note, If your Diameter fall amongst the Divisions, between the Numbers, you must cut off two places from the Product.

Example.

Boung Diameter 71

71

Head Diameter 58

—

200

Casks Length 30

—

Content as before 60.00 Wine Gall.

3. On

3. On a third Face of this Rule (which meets the precedent Line of One thirds of Area's upon one Angle or Edge of the Rule) is put a Line of equal parts, numbred from 1 to 96, and is divided into halves: This Line considered together with that before mentioned, do make a Table of Area's of Circles in Ale Gallons, so that if you find your Diameter in this Line, turn up the other Face, and against your Diameter you shall have the Area of your Circle in Ale measure.

As for Example :

The Diameter of a Circle is 19 Inches, the Area of that Circle upon the other Edge in *Oughtred's* Line is a little above one Gallon.

Again, the Diameter being 30 Inches, the Area is 2.5 Gallons; and if the Diameter be 67 Inches, it holds 12.5 Gallons upon one Inch of depth.

The Use of these Lines, thus together,

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ther, is the same with that of the Table of Area's page 29, &c.

4. On the fourth Side of this Rule is drawn a Line of Numbers, vulgarly called *Gunters's Line*, which Line with a pair of Compasses is of excellent use upon sundry occasions, it being a Line of Logarithms, and by it is performed Multiplication, Division, Extraction of the Square and Cube Roots, and many other Calculations Arithmetical: Of this Line alone, are two or three Books of like magnitude with this already printed, to which for those things I refer you, and shall here only apply it to Cask-Gauging; of which take the following Instructions:

First learn to find any Number upon the Line; from 1 to 10 you have the Figures Arithmetically placed, and the subdivisions are tenths; but from 10 to 20 the divisions signifie each an additional Unite, and so to 100.

At 17.2 you have a small brass Pin, whereon to set the Foot of your Compasses,

passes, and is called the *Gauge-point* for Wine Gallons, almost at 19 is the Gauge-point for Ale Gallons, the first hath wg , and the other ag placed over it, by which they are easily known.

To Gauge a Cask by this Line, you must first find the Diameter at the Head and Bung, and also the Casks Length, by the Line of Inches: These being had, find your mean Diameter, by adding double the Bung Diameter to once the Diameter at the Head, and divide their Sum by 3, the Quote take for your Mean: Then with your Compasses set one Foot in the Gauge-point, and extend the other to the mean Diameter upon your Line of Numbers, so keeping your points at that distance, set one Foot at the number expressing the Casks Length, and from thence double the distance of the Feet of the Compasses exhibits the Content in Ale or Wine Gallons respectively.

As for Example:

A Cask, Bung Diameter 27, Head
24,

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24, Length 30 Inches, if the Content be required in Ale or Wine Gallons, I find the mean Diameter according to the Rule thus :

$$\begin{array}{r}
 27 \\
 27 \\
 24 \\
 \hline
 3 \) \ 78 \ (\ 26 \\
 \underline{18} \\
 0
 \end{array}$$

The mean Diameter being 26, I take my Rule and Compasses, if the Question be Ale Gallons, and set one Foot in the Gauge-point for Ale, and the other I extend to 26, then I take off the Compasses so extended, and setting one Foot at 30, the Length, giving the Compasses one turn upon the other Foot, whereby to take the double distance, and the point toucheth at 57, which is the Content of that Cask in Ale Gallons.

If the Question be Wine Gallons, I take the distance from the Gauge-point for Wine to 26, the mean Diameter, and the Compasses applied to the Casks Length, and turned as before, exhibits 69, the Content of the Cask in Wine Gallons.

This is a very quick and easie way of Gauging Cask, and is also an approximation near enough the truth for common practice.

Having the mean Diameter of any Conical Tun, and the Depth of Liquor, the Quantity is found after the same manner.

Example.

The mean Diameter of a Tun 28, Depth of Liquor 29, Quantity of Ale Gallons will be found $63\frac{1}{2}$.

The common way of finding the mean Diameter of a Conical Tun, is by adding the Diameters above and below together, and take the half. This I allow, as an easie and practical way
for

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for young Gaugers ; but note , that the greater the difference of the Diameters are , the greater is your error , but in Diameters that differ not much , it doth very well.

There is also another Line , that runs parallel with this Line of Numbers , and is called a *Line of Segments* , but I like not the Hypothesis upon which it is framed , and the way of finding the Wants of a Cask (lying with its Axis parallel to the Horizon , being partly empty of Liquor) made so plain and easie , by the precedent Examples upon the Table of Area's of Segments , I had thought to have left it out , but lest any having a Rule and not Table by him , should have such occasion , let him take one

Example.

A Casks Bounge 24 Inches , wet 18 Inches , Content 50 Ale Gallons , what is the Ullage or Wants in this Cask ?

As 24 on the Line of Numbers , is to
Radius

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Radius on the Segments: So is 6 on the Numbers, to 17.8 on the Segments.

Then, As Unity, to 50 on the Numbers: So 17.8 on the Numbers, to 8.9 Ale Gallons, the Wants required.

F I N I S.
